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R&D Manpower Data Badly Flawed, Study Says

Just when the political ether is crackling with concerns about the sufficiency of America's scientific and engineering workforce, along comes a massive study suggesting that the federal government's official manpower statistics belong on the shelf with Alice in Wonderland. The study, *Surveying the Nation's Scientists and Engineers: A Data System for the 1990s*, was produced by the National Academy of Sciences, under contract from the National Science Foundation. Though NSF is the principal producer of the questioned statistics, it has warmly endorsed the NAS findings. The sudden questioning of NSF's official manpower numbers is the statistical version of cold fusion—an astonishing event that invites wonder concerning why we didn't know about it before.

The chimerical quality of the manpower numbers is

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Major Posts Remain Vacant

The old-line Washington science establishment remains on the outside as the Bush Administration enters its third month with a slew of senior sci-tech positions vacant or temporarily filled by restless holdovers.

It is not that science-policy matters are not coming up and being dealt with in some fashion or other. As typified by the protracted inter-agency squabbling over the FSX fighter deal with Japan, many big issues on today's national agenda contain major scientific and technical considerations remote from the professional training and experience of virtually all political decision-makers. Other examples are the space station, whose weak political consensus, developed under Reagan, is slowly unraveling, and SDI, which, it is now obvious, survived mainly on Reagan's deluded enthusiasm.

In the FSX affair, involving development of an upgraded F-16 fighter, the Defense Department insists that sharing some middle-aged American technology is a small price for drawing Japan into a bigger military role on the Soviets' far-eastern flank. The Commerce Department, on the other hand, looks upon technology as a valuable commodity, particularly in aeronautics, as one of the few big remaining items on the positive side of the US trade balance. Commerce has demanded a variety of safeguards against diversion of FSX technology into commercial purposes.

The White House says that a formulation reflecting the concerns of Commerce, Defense, and the Japanese is nearing completion and that, following a review at the Presidential level, it will be submitted to Congress. However, the agencies that would normally be involved in such a review are riddled with vacancies.

The White House Office of Science and Technology Policy (OSTP) has been reduced to a caretaker operation headed by the Reagan-appointed holdover, William R. Graham. Graham has always been tight-lipped about his operations, even down to providing such routine information as the size of his staff. The staff has now dwindled to the point where some of the telephones listed for OSTP do not answer even prolonged ringing.

The status of the White House Science Council remains unclear. Consisting of a dozen or so non-government scientists and engineers on call to advise the Science Adviser, it hasn't met for months.

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In Brief

Demands for austerity confront most federal agency chiefs in the current round of budget hearings on Capitol Hill, but, as usual, the legislators are taking a different approach to the National Institutes of Health. Rather than asking where NIH would cut spending, House Appropriations Subcommittee Chairman William H. Natcher (D-Ky.) gave NIH Director James B. Wyngaarden a homework assignment: What would you do with an extra $500 million? The answer, to be divided into $100 million slices, is due any day.

Retired Bell Labs chief William O. Baker, once a formidable figure in national science politics, has proclaimed that "the near-national hysteria about asbestos may turn out to be one of the major quasi-scientific and technical frauds of the century." That's what he told the New Jersey Board of Higher Education, on which he's a public member, in February just before it created a committee to examine its asbestos-removal policy. Baker referred to concerns about asbestos as "one of the most disturbing exercises of ignorance that we have seen in modern times."

Encountering White House Science Adviser William R. Graham at a Congressional hearing, SGR inquired about appointment of his long-overdue replacement. With a shrug, Graham referred the question to the White House Personnel Office. Asked if he would stay on until a successor arrives, he answered: "No comment."

Jeremy Rifkin, nemesis of biotechnology research and industry, has taken on an additional cause: the greenhouse effect. Rifkin, a prolific bookwriter, campus lecturer, and litigator, is President of the "Greenhouse Crisis Foundation," which has joined with several other groups to campaign against production and use of chlorofluorocarbons.

. . . Variations in Numbers "Not Readily Explained"

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evident in the study's comparison of statistics produced by NSF, the official and most widely quoted source of data on scientists and engineers, and the Current Population Survey (CPS), issued by the Bureau of Labor Statistics from data collected by the Census Bureau.

NSF says that in 1986, scientists and engineers totaled 4,626,500. The count from the CPS is 3,287,000. Within those totals, the figures for some disciplines varied enormously. NSF reported 411,800 "biological and life scientists," while the CPS put their numbers at a mere 65,000. Mechanical engineers, according to NSF, numbered 492,000, but in the CPS version they stood at 287,000.

The NSF version on these matters is widely accepted as gospel, and is routinely and uncritically incorporated into government and private declarations, as well as speeches and legislative proposals on the health and international standing of the American R&D enterprise. But, according to the study, the NSF statistics "are ambiguous, subject to misinterpretation by users, and very difficult to relate to estimates produced by other data systems."

Surveying the Nation's Scientists and Engineers: A Data System for the 1990s (341 pp., no charge). Order from: National Academy of Sciences, Committee on National Statistics, 2101 Constitution Ave. NW, Washington, DC 20418; tel. 202/334-3093.

The study was produced by an NAS panel chaired by Graham Kalton, of the Department of Biostatistics, University of Michigan. The report drew no quibble from William Stewart, the head of NSF's Division of Science Resources Studies, which commissioned and paid for the study. "It's an extremely thorough and competent job of analysis. I can't challenge the criticisms," Stewart told SGR.

Stating that the differences between NSF's manpower figures and those from other sources "are not readily explained," the NAS report adds that "it is hard to know what to make of the fact that the NSF estimate of the total science and engineering population in 1984 is almost twice the Bureau of Labor Statistics (BLS) estimate of employed scientists and engineers, but only three-fifths of the Census Bureau estimate of persons with their highest degrees in a science or engineering field. In addition," the report continues, "NSF estimates of growth rates in the science and engineering population in the 1980s are almost double those estimated from BLS data. We are greatly troubled by these differences," states the report, which was co-authored by Constance F. Citro, who served as study director for the project.

NSF basically assembles science and engineering manpower statistics from the decennial census, updated by a biennial New Entrants Surveys of additions to the professions. "We have to work with the mechanisms available to us," NSF's Stewart told SGR. One area where the mechanisms aren't too good is an important one in science and engineering: immigration. The report notes that the New Entrants Surveys "do not provide good coverage of foreign citizens who received their degrees in the United States, many of whom remain in this country." The Surveys do not include any "foreign (or American) citizens who received their bachelor's or master's degrees abroad and subsequently moved to the United States."

And then there's the matter of a tight budget for the NSF Division of Science Resources Studies, which is also responsible for a great deal of data collection and analysis apart from manpower studies. The Division's budget stood at $4.2 million in fiscal 1985, dipped to $3.8 million in 1987, and currently is $4.3 million, which means that it's lost a good deal of purchasing power over the past five years.

The report explains that discrepancies in the counts arise from a variety of factors, prominent among them NSF's own definitions—some broad, some narrow—of who counts as a scientist or engineer. "The NSF concept of the science and engineering population," the report states, "is broader than that of just current job holders; it includes people who, although not currently employed as scientists or engineers, can be considered as part of the supply pool on the basis of their training and experience. The concept also includes trained scientists and engineers who are working in management or administrative positions." But, the report continues, NSF draws a line: "The concept excludes those who are currently employed in science or engineering if they do not have related training or prior experience"—despite the fact that a 1984 survey indicated that "21 percent of college graduates working in science and engineering occupations received their degrees in other fields. . ."

In general, however, NSF's definitions tend toward producing higher totals of scientists and engineers. "To the extent that new graduates tend to pick their degree field as their occupation when they are really employed in what NSF defines as a non-science and engineering occupation," the

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. . . Does the White House Science Council Exist?

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The members received congenial thank-you notes from Ronald Reagan just before he left office. Graham has recently consulted some of the members by telephone, but SGR is advised that there's some doubt about whether the individuals involved constitute a government advisory body.

The newly created post of Under Secretary of Commerce for Technology is also vacant, following the retirement April 1 of Ernest Ambler, former Director of the National Bureau of Standards, who filled in on an acting basis.

Ambler went off silent in public, but privately expressing exasperation about the Bush Administration's unexplained indifference to the new responsibilities for industrial competitiveness that Congress has assigned to Commerce. The White House's rhetoric of support for those responsibilities is strong, but a leisurely pace prevails in filling the key jobs for carrying them out. Among the posts still filled on an acting basis is the directorship of the National Institute for Standards and Technology, formerly the National Bureau of Standards. Raymond B. Kammer Jr., Deputy Director of NBS, stepped in when Ambler left for the newly created Under Secretary position.

At the Pentagon, at least there's the excuse that the appointment process was set back several months by the fight over the confirmation of John Tower. But a month after Richard Cheney's installation, senior posts remain filled by holdovers—all of whom were required to submit resignations in the final days of the Reagan Administration. Among them is Robert C. Duncan, Director of Defense Research and Engineering, a presidential appointment for which a nominee has not been named.

John Sununu, the White House Chief of Staff, is the name that regularly comes up when the mystery of the vacant science jobs is pondered in Washington science-policy circles. The often-cited presumed clue is that Sununu holds a PhD in engineering—making him a rarity in the White House hierarchy—and that he's got his own ideas about the management of federal science affairs. The publicly available evidence for that, however, is non-existent.

Sununu passed up a natural opportunity for speaking out on science and government when the American Association of Engineering Societies gave him its annual Chairman's Award on April 6. The award honored him for "demonstrating significant applications of engineering to the uses and needs of humanity." Among those attending the award ceremony was Science Adviser Graham, officially resigned, but staying on, though for how long is not clear.

In accepting the award, Sununu confined his remarks to little more than thanks and hurried off.

Statistics

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report states, "the NSF estimates of the science and engineering population will be biased upwards. Moreover, these biases will increase over the decade as new graduates become an ever-larger proportion of NSF's total composite estimate of scientists and engineers and as more recent graduates move away from their field of training."

The report emphatically declares that it does indeed matter that the basic numbers in this area are open to serious doubt. Bringing up the trendy theme of science and engineering and industrial competitiveness, the report argues that "an overriding justification for a national data system on scientists and engineers is to provide information to the Congress, the National Science Foundation, and other federal agencies to flag emerging problems in the supply and utilization of qualified scientists and engineers and to help design and evaluate cost-effective government programs in this area."

The report includes a series of recommendations for improving data collection and analysis by NSF in the next decade.

But it doesn't deal with, or even ask, several disturbing questions: If the numbers are as wacky as the authors suggest, why have they been provided as objective data for public dialog? Laymen are, of course, suckers for "official" statistics. Knowing the weakness of the data it was distributing, why didn't NSF accompany them with appropriate cautions? Given the wildly varying manpower figures cited in the report, how valid are the many current warnings about an impending great shortage of scientists and engineers?

A major factor in the bizarre story of these statistics is that NSF has been required to collect and analyze its numbers on the cheap. The budget sought for next year , $6.1 million, attempts to make up for lost ground. But even so, a lot of explaining remains to be done—DSG

DOD Lists Hot Technologies

Twenty-two technologies deemed "most essential" for developing new weapons have been identified in a report to Congress by the Defense Department and the Department of Energy. The list was prepared at the request of Senator Jeff Bingaman (D-NM), Chairman of the Armed Services Subcommittee on Defense Industry and Technology. Listed are:

Microelectronic circuits and their fabrication; preparation of gallium arsenide and other compound semi-conductors; software producibility; parallel computer architectures; machine intelligence and robotics; simulation and modelings; integrated optics; fiber optics; sensitive radars; passive sensors; automatic target recognition; phased arrays in radar and acoustics; data fusion for integration and interpretation of information; signature control for survivability of weapons; computational fluid dynamics; air-breathing propulsion; high-power microwaves; pulsed power; hyper-velocity projectiles; composite materials; superconductivity; biotechnology materials and processing.

Kennedy Holds Hearing with Ex-Science Advisers

Senator Edward Kennedy joined in the chorus of dismay about the Bush Administration and science affairs with a hearing on April 6 that featured three former Presidential Science Advisers and a prominent might-have-been.

The hearing, titled "America's Leadership in Scientific Research, Education, and Innovation," indicates a resumption of Kennedy's interest in science policy, an area in which he once was a major figure on Capitol Hill. He was a key sponsor of the 1976 legislation that resurrected the White House Science Office three years after Nixon had abolished it. He's a long-time member of the Congressional Board of the Office of Technology Assessment, and was just elected Chairman, a post he held ten years ago. And he's Chairman of the Committee on Labor and Human Resources, which has authorizing jurisdiction over the National Institutes of Health, a share of jurisdiction over the National Science Foundation, and a usefully vague mandate to look into almost any matter concerning health, education, welfare, and so on.

It was under that Committee mandate that Kennedy invited the testimony of Frank Press, President of the National Academy of Sciences, who served as Jimmy Carter's Science Adviser; H. Guyford Stever, a workhorse of the Washington science-advisory system, who was Gerald Ford's Science Adviser; Donald Hornig, of the Harvard School of Public Health, who held the post under Lyndon Johnson, and Lewis M. Branscomb, former IBM Chief Scientist, now at Harvard's Kennedy School of Government, and often mentioned during last year's Presidential campaign as a prospect for Science Adviser if Dukakis were to win.

For an opener, Kennedy asserted that "Today, the engine of America's scientific and technical enterprise is sputtering." He went on to recite the familiar inventory of neglects and failings, from poor performance in science by American students to the increasing share of US patents going to foreigners. "To reverse these trends and restore America's preeminence," he said, "we need strong federal leadership in five critical areas: scientific literacy, scientific and technical personnel, facilities and equipment, research and development, and technology transfer.

"The Science Adviser to the President must play a key role in providing that leadership," Kennedy continued. "I hope that President Bush will act quickly to appoint a Science Adviser. This is not a partisan issue, but it is an issue that needs to be addressed on an urgent basis, with as much bipartisan cooperation as we can muster between Congress and the Administration."

The first witness, Academy President Press, got off to a difficult start by reciting, for at least the dozenth time on Capitol Hill, the scheme he proposed last year for sorting out priorities for federal spending on science and technology (SGR, May 1, 1988: "Priority System Urged to End Strife Over R&D Funds"). The Press formula is not simple, and his unhurried, didactic manner is not always appreciated by legislators who live on the run. After Press had expatiated for about five minutes from a text on his proposed criteria for scrutinizing various major categories of R&D, Kennedy interrupted: "There's got to be more in the first six pages of your testimony, quite frankly, than that we need a careful budget evaluation of these major projects. Or am I missing something?"

Press then said that he would like to have his prepared testimony submitted for the record, and, off the cuff, he explained that federal R&D programs were so widely scattered among executive agencies and Congressional committees that a comprehensive picture was lacking. Basically, he said, he was calling for putting it all together in one package, in the Executive and in Congress, so that the whole could be viewed and evaluated before it was disassembled. For that process, he continued, the role of Presidential Science Adviser was crucial. Kennedy agreed with that.

Praise for 1976 Science-Policy Act

Stever, the first Science Adviser to serve under the legislation that returned on-board science advice to the White House—the National Science and Technology Policy, Organization, and Priorities Act of 1976—said the legislation was sound in its establishment of the Office of Science and Technology Policy (OSTP). What's lacking so far, he said, is Presidential interest in using the office and the authorities contained in the legislation.

Kennedy said he was concerned about Bush's failure to appoint a Science Adviser. Press said, "It is a disappointment that at this late date, we don't have a Science Adviser in position." He noted that "about 100" senior government officials preside over $62 billion in R&D spending. A role he envisaged for the Adviser, Press said, was in providing the President with guidance on these appointments.

Donald Hornig, who holds the endurance record for White House Science Adviser (1963-68), brought an element of reality into the proceedings by noting that the Science Adviser has actually been only a bit player in the grand process of federal R&D policymaking and spending. The National Institutes of Health, he observed, "have always had their own communications channel to the White House and the Congress. OSTP or its predecessors," Hornig continued, "have played only a small part." He added that "Two thirds of the federal R&D budget (about $42 billion) is spent by DOD, with little involvement by OSTP."

OSTP, Hornig said, "does not seem to many to have fulfilled the role which was envisioned in 1976." He went on to say that today it's more important than ever to have wise, influential science advice at the center of government, but it's up to the President to want it.

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After the Valdez Oil Disaster, Here Come the Alibis

An Exxon official's brazen attribution of the Valdez disaster to "an act of God" may be correct in a strict theological sense. But by conventional legal standards, it's as foul as the waters of Prince William Sound after the irresponsible grounding of the company's tanker. The same goes for the public-relations campaign that the oil industry and its friends are mobilizing on a simple-minded share-the-blame theme: Occasional catastrophe is the unavoidable price of a plentiful oil supply.

A public that has been battered by high-tech applications of Murphy's Law, from Three Mile Island to Bhopal, from the Challenger to Chernobyl, does not have to be told that "fail safe" is an illusion. Nor does it need to be instructed that great industrial benefits are unavoidably accompanied by some risk.

The apologists for industrial irresponsibility relish cases of public confusion about risk, such as the recent episodes of pesticides in apples and traces of cyanide in Chilean grapes. They chortle that the public, egged on by consumer and environmental organizations, tends to be childlike in accepting the bounty of industrial society while refusing to face up to how it's produced. That's true to a large extent, but Valdez cannot be excused as simply a cost of rich civilization.

Given the variable performance of humans, and the complexities of machinery, of course things can go wrong, and sometimes will. That being the case, great emphasis belongs to being prepared for mishaps of grave consequence, as rare as these may be. On this point, Exxon has no excuse, least of all that we all share the guilt because we all benefit from an abundance of oil.

In the crucial hours following the rupture of the tanker's hull, equipment for containing the spill was not available, the barge for off-loading oil in emergencies was out of commission, emergency crews were not on hand, and there was no plan in force for swiftly assembling them. Exxon now highlights the risks of shipping oil, but despite every opportunity to be knowledgeable about them, it apparently fell into complacency and did little or nothing to prepare.

The contention that all beneficiaries of oil must share the blame for Valdez contains enough of a nugget of truth to tweak the conscience. If the United States weren't so wasteful with oil, far less would be needed, and there would be less urgency about drilling and pumping in environmentally sensitive areas, such as Alaska.

The reality, however, is that industry and politics have collaborated in misleading the public to believe that cheap energy is an American birthright, and that it's here to stay—despite the gas-line crises of the 1970s. Both the Reagan and Bush administrations have resisted strict application of improved mileage requirements for the automobile industry. Because of low taxes, American gasoline prices are half or less of those in Europe, thus providing minimal incentive for economical cars and frugal use.

European and Japanese manufacturers have developed experimental full-size cars that get 60 to 100 miles to the

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Kennedy

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Branscomb took up the theme of the neglect of science policy by noting that "In Japan, the top science and technology policy body is a council chaired by the Prime Minister, on which sits the Ministers of Finance, Science and Technology, MITI [Ministry of International Trade and Industry], Education, and the academic scientist chairing another body, the Japan Science Council, which looks after basic research.

"In the US," he continued, "we have yet to see the appointment of a Director of OSTP and provision for an adequate staff. We have more powerful policy-analysis capability than does Japan, in key agencies, in the National Research Council, the Congressional agencies like OTA [Office of Technology Assessment], and in the universities. But we do not have in the Executive Office [of the President] a technology expert who can set the agenda, command attention, across the government and outside, and expect to implement what is decided."

Referring to the National Institute of Standards and Technology (NIST), Branscomb said that its budget is inadequate for the industrial-competitiveness responsibilities assigned to it by Congress. He also urged a major role for NIST in engineering education.

NSF, he noted, has three major responsibilities—science, engineering, and education—and could usefully spend its entire budget on each of them.

The dialog at the hearing was frank and informed. No one attending the proceedings could fail to understand that Bush's casual treatment of science and technology affairs is deeply troubling to the leaders of American science and their allies in Congress. It's not self-importance or imperial designs for their profession that is stirring them up. Rather, there's a deep-seated concern that a precious, powerful national resource is needlessly eroding for lack of political attention and not all that much more money. What makes the situation especially frustrating is that Bush continues to speak words of praise for science and technology. But there's nothing to indicate that his interest goes beyond a tip of the cap to another segment of the electorate.

Along with the strong feeling that came out at the hearing, also evident was the fact that the participants realized they were mainly talking just among themselves. Asked why a witness or two had not been summoned from the Bush Administration, a staff member on Kennedy's Committee simply responded, "What would be the use?"

In Quotes: Neglect of College Science Education

From testimony by Jerry A. Ball, Director, Institute for Chemical Education, University of Wisconsin, March 9, to the Science, Research, and Technology Subcommittee of the House Committee on Science, Space, and Technology.

Why has college-level science education tended to be overlooked—indeed neglected, according to several major studies. . . ? The reason is that undergraduate education comes in second on almost everyone's list of concerns.

Consider, first, the scientific community. Their focus is on research and graduate education, the essence of the academic research enterprise. We need only look at NSF's budget over the years to see that the immediate interests of the research community are, understandably, their own research grants, not the educational system that at some time in the future produces new scientists and enlightened citizens. . . .

Consider, second, the public (and therefore the Congress). After the NSF education programs were abolished [on the orders of the Reagan Administration] in 1981—an incredible error—an enormous and appropriate national concern developed for our elementary and secondary education system. Congress had the wisdom to order reinstatement of the Science and Engineering Education (SEE) program at NSF, but there was an oversight. NSF graduate education activity was not eliminated in 1981, and in reinstating the SEE program, only pre-college activities were returned. Undergraduate activities were overlooked, because there was no great public outcry as there was at the pre-college level. Again, undergraduate education was second on everybody's list.

The result is that we have a pipeline with a gaping hole in the middle. NSF typifies and exemplifies this situation nationally. Graduate education continues to be carefully and appropriately attended to by powerful interests. Now pre-college education at NSF and, hopefully in the nation, is beginning to turn the corner, thanks in significant measure to this Committee. But undergraduate education needs serious, long-term attention that parallels the NSF leadership now in pre-college education.

It's a disgrace that our best high school students compare poorly with students from other countries. But, even more disturbing to me is the loss of potential science, mathematics, and engineering students in their freshman and sophomore years in college. Precious few American citizens intend to major in science in college. Worse, in the first two years of college, we lose about 40 percent of that highly selected group who left high school intending to major in science. . . .

Last year we looked with hope as the Division of Undergraduate Education was established within [the NSF directorate for Science and Engineering Education]. And we were, at first, encouraged by all the rhetoric announcing NSF's plans for undergraduate education. But closer analysis has turned the hope to disappointment and finally to dismay. . . .

Inexplicably, the SEE undergraduate budget [currently $28 million, budgeted next year for $30 million] is not being significantly increased and the Foundation has announced that the majority of undergraduate effort will take place in the [NSF] research directorates. . . .The result for the total undergraduate effort is a disjointed array of claims for activity throughout NSF, which is confusing, even mysterious to the national academic community. Not surprisingly, the major thrust in the distributed activities is the support of research, not the educational improvement or instructional development called for by virtually all reports on undergraduate education. . . .

The research directorates' primary interest is and always will be the support of research. They are good at that. . . They will not and are not giving undergraduate education top

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Oily Alibis

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gallon. When the next energy crisis hits, as surely it will, they will be prepared for the new economics of driving, as the Japanese carmakers were with small cars when the 1973 gasoline shortage sent Americans scurrying for mileage economy. American manufacturers have not shown a similar interest in preparing for next time.

Amid the illusion of a permanent plenitude of cheap fuel, federally supported research on alternative energy sources has been sharply reduced. In 1981, for example, the Department of Energy spent $155 million for research on photovoltaics. The sum sought for next year is $25 million. For heating by sunlight, the budget dropped from $121 million to $13 million over the same period.

Marketplace ideologists insist there's no need for government in the solar-research business. If the public wants solar power, they contend, profit-seeking industry will get the message, perform the needed research, and produce the goods.

However, unlike its Japanese competitors, American industry is not inclined these days to dig in for the years and years of research that often underpins high-tech products. On center stage now is the case of high-definition television, abandoned by American industry while firms in Japan have stuck with it for a decade in anticipation of a multi-billion-dollar market in the 1990s.

When it comes to the facts of energy, Americans have been lulled into a dreamworld. Maybe the US deserves what it's getting, plus the even worse difficulties that lie ahead. Even so, the excuses and rationales now being woven around the Valdez disaster are outrageous.—DSG

In Print

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Commercial High-Speed Aircraft: Opportunities and Issues (89-163 SPR; 75 pp., no charge), from the Science Policy Research Division of the Congressional Research Service (CRS), Library of Congress, a guide for evaluating another big-ticket possibility for the national high-tech agenda: NASA's proposal for a 10-20-year government-industry collaboration to develop technology for a high-speed civil transport (not to be confused with the National Aerospace Plane, the aircraft-rocket hybrid under development by the Defense Department). Among the points covered by CRS are the potential for international collaboration, environmental considerations, and budget tensions between NASA's space and aviation responsibilities. The report warns that "The image of being an aircraft that is available only to those sufficiently well off financially to pay high fares could severely hamper" public acceptance. Requested by Congress, the report was prepared by a group headed by Richard E. Rowberg, head of the CRS Science Policy Research Division, and staff members Kathleen Hancock and Christopher T. Hill.

Order from: Library of Congress, CRS-SPR, Attn. Patricia Raap, Washington, DC 20540; tel. 202/707-7014.

The Bridge (quarterly, no charge), magazine of the National Academy of Engineering, regularly contains articles on public-policy issues, including, in the current spring issue, contributions by Rodney Nichols, Executive Vice President, Rockefeller University; Erich Bloch, Director of NSF, and Donald Frey, retired CEO, Bell & Howell Co.

Order from: Editor, *The Bridge*, National Academy of Engineering, 2101 Constitution Ave. NW, Washington, DC 20418; tel. 202/334-1657.

College Science

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priority and the attention it needs. Their distraction with undergraduate education may even be detrimental to their research mission. . . .

Some way must be found to assure that undergraduate programs—teaching and advising undergraduate students, developing and revising courses, laboratory experiments and curricula, and presenting the excitement of learning and discovery to undergraduate students—receive both time and attention from faculty. Experience indicates that this will not happen on campuses with vigorous programs of graduate study and research unless the faculty understands that colleagues as well as departmental and institutional administrations expect this to occur. . .

The availability of funds to support creative work in undergraduate science, engineering, and mathematics education is a powerful incentive to academic administrators...

To the Editor

On February 9, in his first address to Congress, President Bush affirmed his strong commitment to science and engineering research, a position also taken by his predecessor, and set forth an important new dimension in the form of increased federal attention to science and mathematics education.

These positions, along with the proposal to double the National Science Foundation budget, have quite rightly been welcomed by the science and engineering community and the science press. At the same time, there has been some confusion about the accompanying budget details. SGR has, on occasion [Feb. 15], placed the NSF request as much as $100 million higher than reality.

President Bush's budget proposal for NSF for FY 1990 is $2.15 billion. If approved by Congress, it will represent an increment of $262 million over FY 1989, an increase of nearly 14 percent. This budget proposal is identical with that submitted in January by President Reagan.

The Bush budget document *Building a Better America* spoke of an increase of $361 million over 1989 for "science and technology programs" (p. 37). This figure has sometimes been associated in the press with NSF alone, but it actually refers to the combined increases for NSF and the general science programs of the Department of Energy (not counting the Superconducting Super Collider).

There has also been some confusion about the details of the NSF doubling proposal. The original doubling concept, set out in President Reagan's 1988 budget proposal, would have taken NSF from a base of $1.6 billion to $3.2 billion by FY 1992. Actual appropriations in 1988 and 1989 fell substantially below proposed levels, thus altering the timetable.

The Bush budget restores the rate of growth required to resume progress toward the doubling: it specifies outyear increases that will result in an NSF budget of $3.4 billion by 1994.

Sandra D. Toye
Controller
National Science Foundation

(Ed. note: SGR regrets having misread President Bush's budget statement. Incidentally, Bush now specifies Fiscal 1993 as the date for achieving a doubling of the NSF budget—an addition of one year to the five-year timetable announced by Reagan. Attainment of the goal depends on Congressional action, which, as Controller Toye indicates, has so far fallen short.

At this year's House and Senate Appropriations hearings on the NSF budget, the respective Chairmen, Rep. Traxler and Senator Mikulski, both expressed doubts that the funds requested for NSF could be squeezed out of the funds available to their Subcommittees, which also have jurisdiction over NASA, Housing and Urban Development, the VA, and EPA.]

In Print: Health Statistics, OTA List, Global Security

The publications listed are obtainable as indicated—not from SGR.

Health United States: 1988 (GPO Stock No. 017-022-01066-6; 208 pp., $16), 13th annual edition of the basic book of US health data, prepared by the Department of Health and Human Resource, reports vital statistics, health-care expenditures and utilization of resources, biomedical-research spending, manpower trends in the health professions, and a great deal more. The volume is a model of clear, concise presentation of large quantities of information.

Order from: Superintendent of Documents, USGPO, Washington, DC 20402-9325; tel. 202/783-3238.

OTA Publications: 1989 (57 pp., no charge), catalog describing hundreds of reports produced in recent years by the Congressional Office of Technology Assessment at the request of House and Senate committees. Subject categories are Agriculture and Forestry; Biological Applications; Defense; Education and Training; Energy and Mineral Resources; Environment and Pollution; Health; Industry; Information Technology and Services; International Trade, Competition, and Cooperation; Oceans and Water Resources; Science and Technology, Research and Development; Space; Transportation. Included are directions for ordering and a list of studies currently in progress at OTA.

Order from: Publications Office, Office of Technology Assessment, US Congress, Washington, DC 20510-8025; tel. 202/224-8996.

Science and Global Security (quarterly, scheduled to start publication in June), described as an international journal, to be published in English and Russian editions, with emphasis on arms control and environmental issues. The editor is Harold Feiveson, Center for Energy and Environmental Studies, Princeton University. Co-Chairmen of the editorial board are Frank von Hippel, also of the Center, and Roald Sagdeev, former Director of the Soviet Space Research Institute.

For a complimentary first issue and subscription information: Gordon and Breach Science Publishers, Marketing Department, PO Box 786, Cooper Station, New York, NY 10276; tel. 212/206-8900.

Laboratory Accreditation: Requirements Vary Throughout the Federal Government (GAO/RCED-89-102; 37 pp., no charge), report by the General Accounting Office, a Congressional investigative service, requested by the House Science, Space, and Technology Committee, lists 20 federal programs, in 11 agencies, that deal with laboratory accreditation, for which criteria vary widely, the GAO found. Among the labs covered were those delegated to conduct tests for the Agriculture and Defense departments, the Food and Drug Administration, and the Customs Service.

Order from: US GAO, Post Office Box 6015, Gaithersburg, Md. 20877; tel. 202/275-6241.

Report of the National Science Board Committee on Openness of Scientific Communication (NSB 88-215; 8 pp., no charge), by a group chaired by Frank H.T. Rhodes, President of Cornell University, endorsed by the Board, which is the policymaking body of the National Science Foundation, says academe can bed down with industry, the military, and various other funders, and still maintain open communication on the work involved. Directions for accomplishing this feat are limited to exhortations for all parties to be on the alert. (A section of the report denouncing scientific fraud was extensively quoted in SGR last Dec. 15.) The document is mainly of interest because NSF plans to ask all grantee institutions to self-administer a checkup on openness and integrity.

Order from: Forms and Publications, National Science Foundation, 1800 G St. NW, Washington, DC 20550; tel. 202/357-7861.

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